AN ANALYSIS OF SELECTED COGNITIVE AND NON-COGNITIVE VARIABLES RELATING TO A STUDENT'S PERSISTENCE IN A MAJOR AREA OF STUDY AT MICHIGAN STATE UNIVERSITY

Thesis for the Degree of Ed. D.
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Wilma Nash Bradley

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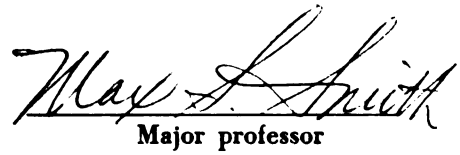

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By

Wilma Nash Bradley

AN ABSTRACT OF A THESIS

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ABSTRACT

AN ANALYSIS OF SELECTED COGNITIVE AND NON-COGNITIVE VARIABLES RELATING TO A STUDENT'S PERSISTENCE IN A MAJOR AREA OF STUDY AT MICHIGAN STATE UNIVERSITY

by Wilma Nash Bradley

The purpose of this investigation was to determine if students who change their major area of study after college entrance differ in certain cognitive and/or non-cognitive variables from students who choose a major area of study at time of college entrance and remain in that major area. Two major hypotheses were formulated: (1) There is no difference between female students who change major on the basis of academic aptitude, critical thinking ability, attitudes, and values, and (2) There is no difference between male students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

A review of the literature revealed no studies directly relating to the problem under consideration.

The population for the study consisted of the American-born freshmen students who entered Michigan State University the fall quarter of 1958 in a specified major area of study and were still enrolled fall quarter, 1961.

The cognitive variables, critical thinking ability and academic aptitude, were measured by the Test of Critical Thinking, Form G and The College Qualification Tests, Total Score, respectively. The non-cognitive variables, attitudes and values, were measured by the Inventory of Beliefs, Form I, Rokeach's Dogmatism Scale, and the Differential Values Inventory, respectively.

Data pertaining to male and female students were examined independently. Data pertaining to those who changed major area of study were classified as above or below a passing grade-point-average of 2.0.

Data relative to the cognitive variables were analyzed by analysis of variance. Due to the significant differences found, the non-cognitive variables were analyzed by the use of analysis of covariance, using the mean scores on the cognitive variables as the control factors. The analyses of the data yielded seven variables of significant difference at the .05 level of confidence, and one (female attitudes) as of no significant difference. On the basis of these results the null forms of the two hypotheses were rejected.

Findings of the study

1. A significant difference was found among the three female groupings on the basis of their academic aptitudes.

2. A significant difference was found among the three female groupings on the basis of their critical thinking abilities.

3. No significant differences in stereotypy and adaptivity were found for the female groupings.

4. A significant difference was found among the three female groups on the basis of their traditional-oriented values.

5. A significant difference was found among the male groupings on the basis of their academic aptitudes.

6. A significant difference was found among the three male groupings on the basis of their critical thinking abilities.

7. A significant difference was found among the three male groupings on the basis of their stereotypic beliefs and receptivity to change.

8. A significant difference was found among the three male groupings on the basis of their traditionally-oriented values.

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CHAPTER I

THE PROBLEM

INTRODUCTION

New students for the undergraduate program at Michigan State University, at East Lansing, Michigan, are encouraged to undergo a pre-entrance testing and counseling program. When this is not feasible, the students are given their orientation tests during registration week, and may or may not undergo subsequent counseling. However, the results of these testing programs are available to the academic advisors for educational and/or vocational guidance purposes.

Students who undergo counseling prior to registration at Michigan State University are encouraged to enter as non-preference freshmen if they have any question relative to their choice of major area of study. However, there are many students who declare a major as entering freshmen, and who later change to different areas of study, and often spend an appreciable period of confusion in the process of making these decisions.

Educators have been aware for some time that many entering college freshmen are in need of guidance if they are to choose a major area of study in which they can hope to succeed. The problem of counseling a student relative to his major area of study is so

aptly described by Whiteley[1] in her discussion of the use of rating scales, in which she points out the difficulties incumbent in their use as indicators of vocational guidance in the statement that

> Given a wealth of information about occupations and accurate measurements of the individual in all his phases, one can only say at most: "If you enter this particular vocation you will have this much in your favor. If you have sufficient determination you may rise above the handicaps and attain to some degree of success in the calling. Science, however, cannot place a tag upon you that will guarantee a safe journey over the road of least resistance to a goal of gratified ambition and unallyed success."

NEED FOR THE STUDY

The administration and faculty at Michigan State University are very cognizant of this problem in counseling students entering the university. Discussions between the investigator and various academic advisors and deans at Michigan State University revealed that they feel this changing-of-major-area-of-study should be of definite concern to all involved. All of these people stated that more information on the entering student would undoubtedly be of help in academic advising. Some feel that information is needed on the students which could be related to previous patterns studied of students with similar record patterns that have found successful fulfillment in their academic programs. Others felt that follow-up studies might be the answer. Everyone contacted at MSU had views on how to attack this problem. However, no one contacted had made any

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[1]Mary T. Whiteley, "An Empirical Study of Certain Tests for Individual Differences," Archives of Psychology, No. 19, (August, 1911), p. 79.

detailed studies to substantiate their theories, nor were there convenient literature references readily available on this subject.

There are many factors involved when considering a study of such problems. What is the effect on the student when making a change in his major area of study? Is the student in a state of confusion and depression at this time? Does his scholastic record decline during this period? Do many students withdraw from school because of this academic indecision?

After due consideration of the many facets of this over-all problem in guidance and counseling, it was decided, for the purposes of this investigation, to make a study of students who change their major area of study after college entrance to determine if there are any significant differences between students who persist in their original choice of major, and those who change to a new major area at the undergraduate level.

THE PROBLEM

Statement of the problem

The purpose of this study is to determine if any differences can be discerned between certain cognitive and/or non-cognitive variables for students who specify a major area of study as entering freshmen at Michigan State University and later change to another major area of study.

Scope of the problem

Since this appears to be a problem in all major areas of

study, it was decided to make this study as inclusive as reasonably possible. On this basis, it was decided to study the entire group of students from one given class who changed major within a determined period of time.

At this time a four-year study[2] was (and is) underway at Michigan State University on academic aptitude, critical thinking abilities, attitudes of stereotypy and dogmatism, and a traditional value orientation. Scores for the tests taken by this group were available, and follow-up studies in progress made current data accessible for this group, hence it was decided to add this study to the already extensive investigation underway using this group of students.

The results of five tests,[3] covering academic aptitude, critical thinking ability, values, and attitudes were determined as the cognitive and non-cognitive variables to use for the purposes of this study. The individual tests, their purpose, general format, reliability, and validity, will be discussed in detail in Chapter III.

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[2]This major study is the parent population of the present investigation, and consists of the American-born students enrolling for the first time (in any college or university) at Michigan State University, fall quarter, 1958, for twelve or more credit hours. This population consists of 2,746 students for whom useable data was complete on the entire general test battery given during fall registration, September, 1958.

[3]The Test of Critical Thinking, Form G;
The College Qualification Tests, Total Score;
The Differential Values Inventory;
The Inventory of Beliefs, Form I; and
Rokeach's Dogmatism Scale, Form E.

Limitations of the study

The limitations within the study appear to fall into three main categories. The first is concerned with the type of institution from which the population was taken. Michigan State University is a land-grant college, and as such differs in its philosophy from that of private colleges and universities, and also from many state universities. It leads one to consider if the results of the study would be different if the attitudes and values of students from a university of different philosophical approach to education were to be considered.

A second limitation could be cited in reference to the choice of the population. The students who withdrew have not been included in this study as they would not be included in the Fall, 1961 enrollment. Also, the study does not include freshmen who entered as non-preference status. Therefore, the group studied is not representative of the entering freshmen at Michigan State University.

A third, and certainly not insignificant factor, is the choice of the non-cognitive factors used as the measured variables for this particular study. Would different variables have led to different conclusions?

These, and possibly other factors, have to be considered in every investigation. For the purposes of this study, the scope and limitations set seemed to be in keeping with the aims of this investigation. This does not, however, rule out the need for future investigation using different population limits and additional or different variables.

DEFINITIONS OF TERMS USED

Cognitive variables

Cognitive variables are defined, for the purposes of this study, as the following tests:

The Test of Critical Thinking, Form G; and,

The College Qualification Tests, Total Score.

Non-Cognitive variables

Non-cognitive variables are defined, for the purposes of this study, as the following tests:

The Differential Values Inventory;

The Inventory of Beliefs, Form I; and,

Rokeach's Dogmatism Scale, Form E.

Changes in major areas of study or majors

Changes in major areas of study, or majors, were defined, for the purposes of this study, by a panel of judges according to the breakdown of the Michigan State University curriculum as given in Appendix A. (Changes such as mathematics to music are considered changes in major areas of study; whereas, changes within the engineering curriculums or to or from the physical sciences are not considered as changes in major area of study.)

The population

The population is defined, for the purposes of this study, as those American-born students who enrolled at Michigan State University

for the first time during the week of registration, fall term, 1958; who were enrolled for twelve or more credits in a specified major area of study; and, who also were enrolled at Michigan State University at the beginning of the fall term, 1961. (This excludes those students who (a) either transferred to Michigan State University after attending another college or university, or (b) were foreign students.) The total number of students considered eligible for this study, and for whom useable data were available, included 561 females and 792 males.

Critical thinking

Critical thinking is defined for the purposes of this study as the ability of a student to carry on types of mental activity more complicated than simple recall and restatement of ideas, facts, principles, etc., as given in a textbook or presented by the lecturer. For the purposes of the Test on Critical Thinking, critical thinking was defined as the ability to particularize.[4]

Values

A value is herein defined as a standard for decision-making, held by an individual student, and to be identified when it is articulated in (a) an expressed verbal statement or (b) response

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[4]This is the definition accepted by the Committee on Measurement and Evaluation in preparation of the items for the Test of Critical Thinking. See Paul L. Dressel and Lewis B. Mayhew, General Education: Explorations in Evaluation. (American Council on Education, Washington, D.C., 1954), pp. 176-7.

to a verbal statement of an overt conduct.[5]

Attitudes

An attitude is a tendency to act for or against something.[6]

Stereotypic beliefs

Stereotypic beliefs is defined, for the purposes of this study, as the body of tenets accepted by a student which depend on irrelevant drives and/or arbitrary reinforcements from external authority.[7]

ASSUMPTIONS UPON WHICH THE STUDY IS BASED

The following assumptions were made as the limiting factors for the purposes of this study:

(a) the group studied is representative of students at this level at Michigan State University who declared a major area of study at time of entrance as freshmen at Michigan State University.

(b) the major listed for the student at time of enrollment, fall quarter, 1961, is assumed, for the purposes of this study, as his final choice of major area of study for the baccalaureate degree at Michigan State University.

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[5]Philip E. Jacob, Changing Values in College: An Exploratory Study of the Impact of College Teaching. (New York: Harper and Brothers, 1957), Forward xii.

[6]This is the definition accepted by the Committee on Measurement and Evaluation in preparation of the items for The Inventory of Beliefs test. Dressel and Mayhew, loc. cit., p. 211.

[7]Milton Rokeach, The Open and Closed Mind. (New York: Basic Books, Inc., 1960), p. 61.

HYPOTHESES TO BE TESTED

Hypothesis I

There is no difference between female students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

Hypothesis II

There is no difference between male students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

ORGANIZATION

The general plan of the study has been organized into five chapters:

Chapter I: The introduction presents the problem, its scope, the definition of terms, the assumptions upon which the study is based, and the hypotheses to be tested.

Chapter II: The survey of the literature includes a brief review of the useage of rating scales and the related studies published to date, and a summary.

Chapter III: The methodology presents the limitations of the study, a description of the tests used, and the statistical techniques used to analyze the data.

Chapter IV: The analysis of the data includes the results of the statistical analyses of the data, the findings, and the interpretations of the results.

Chapter V: The final chapter presents a summary of the findings of the study, the conclusions based on the findings, and the implications for further study based on these findings and conclusions.

CHAPTER II

LITERATURE

A variety of studies have been undertaken in recent years in attempts to determine if certain cognitive and/or non-cognitive factors can be associated with a personality pattern that is indicative of educational and/or vocational success in certain occupational areas. A few of these studies, concerned with the methods and variables under consideration in this investigation, are cited here as a background for this study.

RATING SCALES

History of rating scales

The use of rating scales as supplementary aids in academic and vocational guidance is considered to date back to the 1880's, when Galton[1] in England devised a series of mental and physical tests which could be given to a large number of individuals concurrently. Prior to this experimental psychology had been concerned with the single individual and how he perceived himself in relation to his external world.

The work by Galton opened an entire new world of investigation,

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[1]Francis Galton, Inquiries into Human Faculty and Its Development (London: Macmillan & Company, 1883), pp. 3-83.

and Cattell and Farrand[2] attempted to determine a relationship between a variety of human traits and academic success. Their data provide some of the first information concerning relationships of individual differences. However, much of the data collected in these testing programs by Cattell and others were done for the single individual and were based to a great extent upon the interpretation of the interviewer on non-cognitive aspects of the individual; for example, personal appearance, type of feature and coloring, attitudes, and personal behavior.

Studies done in the early years of this century at the University of Chicago show that at that time it was apparent to college faculty and administrators that over a third of the students were in need of vocational counseling at the time of entrance to the university.[3] In 1913 a system of psychological examinations for entering students was introduced at the University of Chicago for the general purpose of advising in educational guidance.[4] These rating scales were predominantly of the type to ascertain academic ability or aptitude.

Hence, an understanding of problems related to educational and vocational guidance has been of concern to college personnel for over a half century.

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[2]J. McKeen Cattell and Livingston Farrand, "Physical and Mental Measurements of the Students of Columbia University," Psychological Review, Vol. 3 (1896), pp. 618-48.

[3]Harry Dexter Kitson, "The Scientific Study of the College Student," Psychological Monographs, Vol. 23, No. 98 (1917), p. 72.

[4]Ibid., p. 14.

Studies done with rating scales

Rating scales have been, and are being used with increasing frequency in attempting to predict academic and vocational success. One of the predominant tests used in such investigations is the Minnesota Multiphasic Personality Inventory (MMPI). Norman and Redlo,[5] using the MMPI in rating satisfaction with major area of study, reported that:

1. The MMPI is valid for distinguishing personality trends amongst various major groupings. Certain scales significantly discriminated major groupings from the remainder of the students.

2. There is a tendency for students who are strongly satisfied with their major to resemble their own groupings on discriminative scales.

3. Significant differences were found between strongly satisfied and satisfied-and-less students on Mf (masculinity-feminity) and Pt (psychoasthenia). The former were higher on Mf, and the latter on Pt.

4. When mean T-score deviations from average T-scores are calculated, there is a tendency for students who would rechoose the same major to deviate less from their own groupings than those who would rechoose a different major.

It will be noted that this study showed definite personality trends for major areas of study, and that students within a specific major area tend to resemble each other.

In another investigation conducted by Centi[6] relative to the

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[5]Ralph D. Norman and Miriam Redlo, "MMPI Personality Patterns for Various College Major Groups," Journal of Applied Psychology, Vol. 36 (Dec., 1952), p. 409.

[6]Paul Centi, "Personality Factors Related to College Success," The Journal of Educational Research, Vol. 55, No. 4 (Dec.-Jan., 1962), pp. 187-8.

effect on achievement of selected personality factors, using the MMPI, the results of the study indicated that a definite relationship existed between the level of achievement and certain selected adjustment factors. However, it must be remembered that Centi's study was for only one major area of study--education majors.

RELATED STUDIES

An investigation by Warnath and Fordyce[7] in the relationship between non-intellective factors and a student's selection of a major in which he meets with the best chance of success, revealed that significant differences in value patterns emerged on the Poe Inventory of Values (PIV) between the five groups of freshmen divided in the major areas of study they indicated at time of testing. The areas indicated were humanities, natural science, business, social science, and education. This study indicated that the PIV is of definite value in differentiating between students at the beginning of their freshman year relative to their choice of major. The study revealed that students entering as business majors were low on aesthetic, intellectual, religious, and humanitarian scales but high on material values scores; humanities majors were high on the aesthetic and humanitarian scales; the natural science majors were low on the aesthetic scales but high on the intellectual scales; but, the social science and education majors did not show definitive patterns except

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[7]Charles F. Warnath and Hugh R. Fordyce, "Inventoried Values of Entering College Freshmen," Personnel and Guidance Journal, Vol. 40, No. 3 (Nov., 1961), pp. 277-281.

that the education majors tended to be low on the intellectual scales and about average on the aesthetic scales. Here again the study indicates that students within a specific major area of study tend to resemble other students within that same grouping.

A number of research studies have been devoted to the use of groups of tests for prediction of differential success in college. Horst[8,9] presented relatively elaborate procedures for selecting sub-tests from a large test battery which would predict relative success in a student's college curriculum. However, a subsequent study by Eells,[10] using sub-battery-groups (for Liberal Arts, Engineering, and Commerce), led to the conclusion that separate prediction batteries for different curricular groups are of doubtful usefulness.

In a study by Middleton and Guthrie,[11] in which they were attempting to delineate the personality syndromes among high and low achieving students, they found that different grouping of personality factors can apparently be associated with different levels of achievement.

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[8]Paul Horst, "A Technique For the Development of a Differential Prediction Battery," Psychological Monographs, Vol. 68, No. 9, Whole No. 380 (1954), pp. 1-31.

[9]Paul Horst, "A Technique For the Development of a Multiple Absolute Prediction Battery," Psychological Monographs, Vol. 69, No. 5, Whole No. 390 (1955), pp. 1-22.

[10]Kenneth Eells, "How Effective is Differential Prediction in Three Types of College Curricula?" Journal of Educational and Psychological Measurement, Vol. 21 (Summer, 1961), pp. 459-471.

[11]George Middleton, Jr. and George M. Guthrie, "Personality Syndromes and Academic Achievement," Journal of Educational Psychology, Vol. 50 (April, 1959), pp. 66-69.

Many other independent investigations have been conducted on the relationships between a student's values and other aspects of his career. One of the better known studies in this area would be that of Philip Jacob[12] in which the central problem studied was relative to what changes occur in students' patterns of value during college. The overall conclusions of the study revealed that "college does make a difference--but not a very fundamental one for most students. Basic values remain largely constant through college."

Numerous studies have been conducted on students' attitudes. The Mary Conover Mellon Foundation has supported an extensive program of study for the purpose of increasing the understanding of the learning and personality development of the student. Webster[13] reports from one of these studies that his data support the theory that substantial changes take place in the attitudes of a student during his college career.

The stereotypic beliefs of students are probably one of the most difficult aspects of a student's attitudes to work with. Research as a whole tends to agree with the work of Frumkin,[14] which showed that stereotypy is a function of the level of education, and as the student advances in college he becomes less dogmatic. This

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[12]Jacob, loc. cit., p. 38.

[13]Harold Webster, "Changes in Attitudes During College," The Journal of Educational Psychology, Vol. 49 (June, 1958), pp. 109-117.

[14]Robert M. Frumkin, "Dogmatism, Social Class, Values, and Academic Achievement in Sociology," The Journal of Educational Sociology, Vol. 34 (May, 1961), pp. 398-403.

was also shown in the study by Payne[15] who found that test-retest data using the Inventory of Beliefs and the Differential Values Inventory indicated that students became less stereotypic during their freshman year in college; and, that many students, both male and female, exhibit significant values changes and become less traditional upon completion of one year of college.

In a study of the authoritarian type personality; Neel[16] found that this type person has difficulty in mastering theoretical material, whereas this type learns more easily where factual materials are used. It should be noted that this study was based upon thirty senior medical students in one psychiatry course, and may not apply to students of different curricular backgrounds.

A preliminary report[17] published on the initial phase of the four year study using the parent population of this study considered the two hypotheses:

1. There is a significant relationship between various measures of scholastic performance and critical thinking, attitudes, and values.

2. The prediction of scholastic performance can be increased by the inclusion of a battery of affective variables.

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[15]Isabelle K. Payne, "The Relationship Between Attitudes and Values and Selected Background Characteristics," (unpublished doctoral dissertation, College of Education, Michigan State University, 1961), pp. 77-81.

[16]Ann Felinger Neel, "The Relationship of Authoritarian Personality to Learning: F Scale Scores Combined to Classroom Performance," Journal of Educational Psychology, Vol. 50 (Oct., 1959), pp. 195-199.

[17]Irvin J. Lehmann, "The Relationship Between Scholastic Performance and Critical Thinking; Attitudes, and Values," 17th Yearbook of National Council on Measurements Used in Education (1960), p. 84.

The results were summarized, after adjustment for CQT, as follows:

1. Non-stereotypic and non-dogmatic students receive significantly higher examination grades in both CS (communication skills) and NS (natural science).[18]

2. The "better" critical thinkers receive significantly higher grades from their NS instructors and on the CS and NS final examination. They also have a higher first-term GPA.

3. The non-dogmatic students are superior performers in terms of CS and NS.[19]

Another report on this same overall study revealed in the initial phase of this study that:

1. There are significant socio-cultural differences in selected cognitive and affective variables.

2. There are significant differences in stereotypy, critical thinking ability, general academic aptitude, and socio-economi-educational index between students who complete their freshman year and those who withdraw from college during their first year.

3. The relationship between grades (and over-all academic performance as measured by the grade-point-average) and the affective variables varies for different courses and terms. The relationship is generally lower than that between grades and the cognitive measures.

4. Over a period of time, students become less stereotypic, better critical thinkers, and more emergent in their values.[20]

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[18]CS (communication skills) and NS (natural science) are required general education courses at M.S.U. and are normally taken during the freshman year.

[19]Lehmann, loc. cit., p. 87.

[20]Irvin J. Lehmann and Stanley O. Ikenberry. Critical Thinking, Attitudes, and Values in Higher Education: A Preliminary Report. (Paul L. Dressel, Principal Investigator) East Lansing, Michigan: Office of Evaluation Services, Michigan State University, (1959), p. 86.

Lehmann and Ikenberry[21] report that their study revealed that the least stereotypic females were predominantly in the areas of humanities and social science; the more stereotypic females were found in medical technology; the least stereotypic males in physical and biological sciences; and, the more stereotypic males in the education curricula. However, it should be noted that their study also revealed that though the more dogmatic males were found in physical education, they were also poorest on cognitive measures, whereas, the less dogmatic males in the sciences also rated much higher on the cognitive measures.

The above reports support the view, inherent in this investigation, that differences do exist between groups of students, and that students might be grouped according to these differences. They also support the view that a student's success in a given academic area of study may be related to attitudes, values, and critical thinking abilities. The study of Lehmann and Ikenberry indicates that success or failure in certain areas may be predictive from these variables, as is seen, for example, in the high stereotypy and low critical thinking ability of males in physical education as against males in science who were less dogmatic and higher on aptitude and critical thinking scales.

Another brief publication on this same population reported that:

Students tend to become more receptive to new ideas and to

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[21] Ibid., p. 27.

question more deeply during the four years in college.[22]

Another area investigated in attempting to establish predictor patterns is represented by the study done by Holland[23] in which he explored the usefulness of nonintellectual factors in the development of a theory of academic prediction by the use of college grades. However, his findings appeared to be inconclusive for developing such a theory.

In another study using grades as the measure of achievement, Marshall and Simpson[24] reported that the student who comes to college with a definite vocational field in mind has an advantage over the undecided student. They found that the students who are definite in their vocational choice on college entrance rank lower in academic aptitude than those making tentative vocational choices, but the academic performance of both of these groups (as measured by grades) is definitely higher than the entering college students who are undecided as to their vocational choice.

A study by Brass[25] of students who changed schools within

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[22]Irvin J. Lehmann, "Students' Ideas Do Change," State News, Vol. 53, No. 198 (May 15, 1962), p. 1.

[23]John L. Holland, "The Prediction of College Grades from Personality and Aptitude Variables." The Journal of Educational Psychology, Vol. 51, No. 5 (Oct., 1960), pp. 245-254.

[24]M. V. Marshall and E. W. Simpson, "Vocational Choice and College Grades," Journal of Educational Research, 37 (Dec., 1943), p. 303.

[25]Robert V. Brass, "An Investigation of Selected Personal Background Factors and Reasons Related to Students who Change Schools Within Purdue University," (unpublished doctoral dissertation, Dept. of Psychology, Purdue University, 1956), p. 84.

Purdue University revealed that students who transferred from one degree-granting curriculum to another tended to increase their grade-point-average after changing curricula.

However, a contemporary study by Fullmer[26] revealed that students who change major persevered longer than non-changers, and that fewer students withdrew failing than in the non-changers group. Other information collected on these groups relative to academic success revealed no significant differences in the mean grade-point-average of the two groups; mean grade-point-average was not changed significantly after change (correlation of .98 before and after change); and, the non-change group scored highest on the American College of Education Psychological Examination.

There is a divergence of opinion as to the relative equality of the sexes, which seems to depend on large measure on which traits are being considered. Kuznets and McNemar[27] found that when large unselected groups were tested, when age was considered, and bias on test items allowed for, little or no difference between the mental abilities of the sexes was found.

A study by Abelson[28] on predictability of freshman grades

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[26]D. W. Fullmer, "Success and Perseverance of University Students," Journal of Higher Education, Vol. 27 (1956), pp. 446-447.

[27]G. M. Kuznets and Olga McNemar, "Sex Differences in Intelligence-Test Scores." The Thirty-ninth Yearbook, NSSE (Bloomington, Ill.: Public School Publishing Company, 1940), pp. 211-20.

[28]Robert P. Abelson, "Sex Differences in Predictability of College Grades," Educational and Psychological Measurements, Vol. 12 (Autumn, 1952), pp. 638-644.

for the separate sexes revealed a highly significant sex difference when the prediction was based on high school grades, but no significance when aptitude test scores were the predictors. However, using both high school grades and aptitude test scores simultaneously, the over-all test was highly significant.

Researchers have shown that there are significant sex differences in attitudes and values. For example, Allport, Vernon, and Lindzey[29] reported that women are high on aesthetic, social, and religious scales, whereas men are higher on the theoretical, economic, and political scales.

Studies on the parent population of this study revealed that differences exist between the sexes on all of the non-cognitive factors being considered in this investigation.[30]

A number of studies have been conducted on why students change their major while in college. In his study of curricula changes at Purdue, Brass[31] found that the majority of reasons given by the students for changing major involved interest changes, curricular preferences and dissatisfaction, and generally low grades.

On the whole, studies dealing with why students change major are not directly related to the present investigation. However,

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[29]Gordon W. Allport, Philip E. Vernon, and Gardner Lindzey. Study of Values: A Scale for Measuring the Dominant Interests in Personality, Manual of Directions (Houghton Mifflin Company, 1951), p. 17.

[30]Lehmann and Ikenberry, loc. cit., p. 17.

[31]Brass, loc. cit., pp. 79-81.

the study by Pierson[32] would undoubtedly be the closest related in background and time as it used Michigan State University graduates with the bachelor's degrees in June, 1958. This study revealed that the three predominant reasons for changing majors were

(1) the extent of curricular opportunities in the University,
(2) the content of courses in their original major, and
(3) the requirements and opportunities in vocations related to their original choice.

It must be noted that, in contrast to Brass's[33] study and the present investigation, Pierson classed changes within an area, such as from engineering to physical science, as changes of major. It might be noted that Pierson's post-graduation study revealed that eighty-five per cent of the graduates appeared to be satisfied with their final choice. However, it should be remembered that the group studied are those students who had successfully completed a major area of study for a bachelor's degree. This does not include students who did not finish, which the present study will undoubtedly include. Also it does not show any relationship between a student's cognitive and/or non-cognitive variables as related to the reasons why he changed major. As stated above, this type of study does not lend itself to clarifying the issues being considered in this investigation.

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[32]Rowland R. Pierson, "Changes of Majors by College Students," Personnel and Guidance Journal, Vol. 41 (Jan., 1962), p. 461.

[33]Brass, loc. cit.

SUMMARY

As can be seen from the representative studies cited, many investigations have been conducted, or are in progress, on a student's attitudes, values, stereotypic beliefs, and academic aptitude. Many of these studies have used various rating scales as the predictors as related to the cognitive and/or non-cognitive factors investigated.

The use of rating scales as related to academic aptitude have not been reviewed to any appreciable extent in this section for two reasons, (a) the reader is undoubtedly familiar with many studies citing the use of rating scales as indicators of students' academic ability and (b) the validity and reliability of the cognitive variables used in this study are discussed in Chapter III.

Other studies have been conducted in attempting to establish personality patterns as related to such items as college grades; sex; and, other variables not directly related to this study. However, the factors associated with specific major areas of study have not been of a nature as to allow one to indiscriminately predict that <u>this</u> student will achieve more in <u>this</u> area of study, to the exclusion of all other areas of interest.

It has been the purpose of this chapter to show that numerous investigations have been conducted on students' attitudes, values, beliefs, and aptitudes. However, none of these studies have adequately explained if any differences exist between students who change from one major area of study to another, as related to students who choose a major and remain in the major area of study through their undergraduate program.

CHAPTER III

THE METHODOLOGY

DEFINITION OF THE POPULATION

All students who entered Michigan State University the fall quarter of 1958 as new, American-born freshmen with a specified major area of study, and who were still enrolled at Michigan State University in the fall quarter of 1961 were identified for the purposes of this study. This group, for which useable data were available, consisted of 1353 cases (561 females and 792 males) of which 690 remained in their original choice of major area of study, and 663 changed their major area of study.

SOURCE OF THE DATA

The data for this study were collected at Michigan State University, located at East Lansing, Michigan.

DESIGN OF THE STUDY

The two groups, consisting of 690 non-changers and 663 changers, were each subdivided into two groupings on the basis of sex, giving

a. non-changers, female (288)

b. non-changers, male (402)

c. changers, female (273)

d. changers, male (390)

Groups (c) and (d) above were again subdivided according to the cumulative grade-point-average at the time of change of major, as to whether the grade-point-average was above or below 2.0, which is the passing grade of C on the four-point-system[1] used at Michigan State University. The resultant six groups used in this study are given in Table 1.

TABLE 1

IDENTIFICATION OF THE GROUPS USED IN THE STUDY

Group	Status	G.P.A.[a]	Sex	Number
I	non-changers	.....	female	288
II	non-changers	.....	male	402
III	changers	below 2.0	female	40
IV	changers	below 2.0	male	106
V	changers	2.0 +	female	233
VI	changers	2.0 +	male	284

[a]G.P.A. at time of change of major.

COLLECTION OF THE DATA

The scores on the rating scales used in this study were a part

[1]Grade-point-system at Michigan State University:
A = 4.0 points per credit hour
B = 3.0 points per credit hour
C = 2.0 points per credit hour
D = 1.0 points per credit hour

of the information collected during the registration period, September 21-26, 1958, on entering freshmen at Michigan State University.

The names, student numbers, and grade-point-averages for the individual members used in this study were obtained from the Office of the Registrar at Michigan State University.

DESCRIPTION OF THE INSTRUMENTS

In order to achieve the purposes of this study, it was necessary to obtain measurements of the academic aptitude, attitudes, values, and stereotypic beliefs of all students in the study.

The following instruments were selected to measure the above characteristics. Each of these rating scales will be discussed in relation to the purpose of the instrument, evidences of validity and reliability, and other distinguishing characteristics.

The Test of Critical Thinking, Form G

The Test of Critical Thinking, Form G, was developed as part of the Cooperative Study of Evaluation in General Education, under the sponsorship of the American Council on Education, Committee on Measurement and Evaluation.[2]

The test consists of fifty-two objective-type questions, which were built from the definition that "an attitude is an emotional tendency, organized through experience, to act for or against

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[2]Dressel and Mayhew, loc. cit., pp. 174-207.

something."[3] The skills chosen by the committee for the test items in form G were selected to fall into the following categories:

1. The ability to define a problem.
2. The ability to select pertinent information for the solution of a problem.
3. The ability to recognize stated and unstated assumptions.
4. The ability to formulate and select relevant and promising hypotheses.
5. The ability to draw conclusions validly and to judge the validity of inferences.[4]

The reliability of the test, as given in the manual for the Test of Critical Thinking,[5] was reported as ranging from .71 to .89. A reliability coefficient of .79 was found by Lehmann and Ikenberry.[6] The committee was aware that reliability was being sacrificed for expediency when the test was limited to a 50-minute period.[7]

The validity of the test as determined in relationship to the American Council on Education Psychological Test is reported in the manual for the Test of Critical Thinking as .54.[8]

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[3] Ibid., p. 211.

[4] Ibid., II, pp. 179-180.

[5] Cooperative Study of Evaluation in General Education, Paul L. Dressel, Director. Instructor's Manual for the Test of Critical Thinking, Form G, The American Council on Education, Committee on Measurement and Evaluation, 1953 (Mimeographed).

[6] Lehmann and Ikenberry, loc. cit., p. 12.

[7] Cooperative Study, loc. cit., p. 6.

[8] Ibid., p. 10.

College Qualification Tests

The College Qualification Tests consist of a series of three ability tests developed for colleges for use in admissions, placement, and guidance procedures. These tests were developed to predict learning in the cognitive fields and "the majority of the coefficients found in the prediction of grade-point-average in fourteen institutions strongly indicate that . . . the CQT-Total Score appears to be highly predictive of first semester grade-point-averages . . ."[9]

The College Qualification Tests consist of three subtests which consist of 75 items designed to measure verbal ability, 50 items which measure skill in handling numerical concepts, and 75 items on general information. The Total Score was used in preference to the separate sub-tests because of its greater general predictive power.[10]

The manual for the College Qualification Tests reports a reliability coefficient to approach or exceed .90.[11]

The College Qualification Tests, Total Score were found to be a very good predictor for first semester grade-point-averages in the fourteen institutions where it was used. Hence the manual reports the validity of the College Qualification Tests, Total Score as very favorable for forecasting college success.[12]

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[9]George K. Bennett, Marjorie G. Bennett, Winburn L. Wallace, and Alexander G. Wesman, College Qualification Tests, Manual, 1957 (New York: The Psychological Corporation, 1957), p. 25.

[10]Ibid., p. 50.

[11]Ibid., II, p. 28.

[12]Ibid., III, p. 25.

Inventory of Beliefs, Form I

The Inventory of Beliefs, like the Test of Critical Thinking, was developed as part of the Cooperative Study of Evaluation in General Education, under the sponsorship of the American Council on Education, Committee on Measurement and Evaluation.[13]

The fundamental assumption underlying the Inventory of Beliefs is that "the objectives of general education can serve as a base from which may be inferred the model organization characterizing the personalities of those most adaptable to the purposes of general education."[14]

The Inventory of Beliefs test consists of 120 statements dealing with (a) ideas and intellectual abstractions; (b) social groups and identifications; (c) interpersonal relations; and, (d) the self. Responses to these items are made by means of a four-element key: strongly agree, agree, disagree, strongly disagree. The Inventory of Beliefs identifies students who tend to accept stereotypes. Hence, individuals who reject the majority of the statements (or high scorers) are considered to be more adaptive, independent, and non-stereotypic in belief systems.[15]

The reliability as reported in the manual for the Inventory

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[13]Dressel and Mayhew, loc. cit., pp. 208-241.

[14]Cooperative Study of Evaluation in General Education, Paul L. Dressel, Director. Instructor's Manual for the Inventory of Beliefs, The American Council on Education, Committee on Measurement and Evaluation, 1953 (Mimeographed). p. 4.

[15]Ibid., p. 9.

of Beliefs, shows a median of .86, calculated by the Kuder-Richardson split halfs method.[16]

The validity for the Inventory of Beliefs was studied in several different ways, and finally the test was designed to serve two purposes:

> one relative to the achievement of the objectives of general education and the second related to personality dimensions which are, at one and the same time, the psychological base for the product of effective general education.[17]

The manual for the Inventory of Beliefs reports the validity as .35 in terms of psychological dimensions, using the American Council On Education Psychological Examination.[18]

Differential Values Inventory

The Differential Values Inventory was developed by Richard Prince[19] using the new concepts of values of Spindler, who categorized values as traditional and emergent.[20]

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[16] Ibid., II, p. 5.

[17] Ibid., III, p. 9.

[18] Ibid., IV, p. 10.

[19] Richard Prince, "A Study of the Relationship Between Individual Values and Administrative Effectiveness in the School Situation," (unpublished doctoral dissertation, University of Chicago, 1957).

[20] George Spindler, "Education in a Transforming American Culture," Harvard Educational Review, Vol. 25 (Summer, 1953), p. 149:

TRADITIONAL VALUES:
Puritan Morality
--respectibility, thrift, self-denial
Work-success Ethic
--successful people work hard to become so

The test consists of 64 forced-choice items and was designed to "determine whether the individual holds to the traditional set of values--Puritan morality, individualism, work-success ethic, and future-time orientation--or to the emergent set of values--relativistic moral attitude, conformity, sociability, and present-time orientation."[21] Items in each of the four traditional categories are paired four times with items in each of the four emergent categories.

The individual chooses either the traditionally-oriented or the emergent-oriented statement, giving a traditional score of 0-64. (Subscores, not used in this study, are also available for each of the value-areas measured.) A high traditional score indicated that the person emphasizes respectability, self-denial, hard-work as a measure of success, and a need to build for the future.

Lehmann and Ikenberry[22] found correlation coefficients of .61

Individualism
--the individual is more important than the group
Achievement Orientation
--success is a constant goal
Future-time Orientation
--the future is most important

EMERGENT VALUES:
Sociability
--suspicious of solitary activities
Relativistic moral attitude
--morality is what the group thinks is right
Consideration for others
--harmony of the group should not be disrupted
Hedonistic, present-time orientation
--enjoy the present
Conformity to the group
--everything is relative to the group

[21] Prince, loc. cit., pp. 135-6.

[22] Lehmann and Ikenberry, loc. cit., pp. 32-36.

for males and .60 for females when Michigan State University freshmen were re-tested on the Differential Values Inventory at the end of the freshman year, indicating a reasonable stability in the value scores.

Rokeach's Dogmatism Scale, Form E

The primary purpose of the Dogmatism Scale,[23] is "to measure individual differences in openness or closedness of belief systems." The scale also serves to measure general authoritarianism and intolerance.

The construction of the test is essentially deductive in nature, consisting of the best 40 items taken from the original Form D, and scored on a 7-point agree-disagree scale, and stated in such a way that a high score indicates that the person is highly dogmatic[24] in his beliefs.

Rokeach[25] reports correlations found between intelligence, using the American Council on Education Test, and the Dogmatism

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[23]Milton J. Rokeach, The Open and Closed Mind (New York: Basic Books, Inc., 1960), p. 71.

[24]Milton J. Rokeach, "Political and Religious Dogmatism? An Alternative to Authoritarian Personality," Psychological Monographs, 70: No. 425, (1956), p. 5.

Rokeach has defined dogmatism in the following manner: (Dogmatism) represents a total ideological defense against threat and at the same time a cognitive framework for staisfying one's need to know and comprehend the world one lives in. In other words, dogmatic thinking and believing makes it possible to ward off threatening aspects of reality and at the same time gives one the satisfaction of feeling that one understands it.

[25]Rokeach, loc. cit., p. 190.

Scale, as -.02. Hence, Rokeach concludes that the findings cannot be accounted for by differences in intelligence.

Lehmann and Ikenberry[26] found an internal consistency reliability of .76 for the Dogmatism Scale. They also reported a high correlation in the relationship between Rokeach's Dogmatism Scale and the Inventory of Beliefs.[27] The high correlation of these two independently constructed scales, measuring theoretically related phenomena, tends to support the claim for validity of both measures.

STATISTICAL TREATMENT OF THE DATA

Significant difference in attitudes and values for males and females are reported in the Allport-Vernon-Lindzey Test manual.[28] Also, Lehmann and Ikenberry[29] reported that significant sex differences were found on all the tests used in this investigation except for the Test of Critical Thinking. Since information would appear to be of more significance for the separate sexes, the grouping of the population and control group were made so that Groups I, III, and V (see Table 1) were studied as a unit, and Groups II, IV, and VI (see Table 1) as a unit.

The hypotheses were stated in the null form which postulates, by definition, that the difference in the population means is zero.

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[26]Lehmann and Ikenberry, loc. cit., p. 12.

[27]Ibid., pp. 55-6.

[28]Allport and others, loc. cit., p. 4.

[29]Lehmann and Ikenberry, loc. cit., p. 17.

A statistical method commonly used for testing for significance of difference among the means for two or more groups is the analysis of variance. The analysis of variance procedure for the difference in means is based on the separation of a total sum of squares into several portions. If the mean square for the means is significantly large, the hypothesis of equal means is rejected.

An analysis of variance was made on each of the groupings for the Test of Critical Thinking, Form G, and the College Qualification Tests, Total Score. The results of these analyses of variance, showed significant differences between the means for the tests relating to academic aptitude.

In order to determine if any significant differences exist in relationship to the non-cognitive variables, it was decided that the information would be more pertinent if a statistical technique were employed wherein the differences in academic aptitude could be controlled. Since the analysis of covariance provides the investigator with a means of controlling the individual differences, it was decided to use this method of analysis for the non-cognitive variables. The analysis of covariance procedure also leads to a test for difference in means by separation of a sum of squares into several portions. In this case one tests for a difference in means of residuals. The residuals are the differences of the statistical observation and a regression quantity based on the associated variables.

In order to minimize the bias for scholastic aptitude and academic ability on the other criterion measured, the Test of Critical

Thinking, Form G, and the College Qualification Tests, Total Score were used as the control variables in this investigation.

CHAPTER IV

ANALYSIS OF THE DATA

The analysis of the data will be presented in two parts, in relationship to Hypothesis I and Hypothesis II. Data pertaining to male and female students were examined independently because of sex differences found in initial studies on the parent population.[1] Values used for means, correlations, and standard deviations in this study (Appendix B) were computed on the Michigan State Integral Computer, MISTIC.[2]

The analysis of variance and analysis of covariance techniques were used to ascertain whether differences between the groupings could be accounted for by chance. A significant difference is interpreted to mean significant at or beyond the .05 level of confidence.

HYPOTHESIS I

> There is no difference between female students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

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[1] Lehmann and Ikenberry, loc. cit., p. 17.

[2] Computer Laboratory, Michigan State University, "K5-M, Correlation, Means, Standard Deviation, Variance Card Input," MISTIC Library Index, East Lansing (April, 1959, Mimeographed).

Academic aptitude

TABLE 2

TEST OF SIGNIFICANCE FOR ACADEMIC APTITUDE FOR GROUPS I, III, AND V FEMALES

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Total	560	317,869		
Groups	2	8,190	4095	
Within	558	309,679	554.99	7.3785

Results of the analysis of variance for The College Qualifications Test, Table 2, revealed that there is a significant difference among the three female groups in their academic aptitudes. Reference to Table 3 shows that the group of students who changed major with a passing grade-point-average rated the highest on the academic aptitude test, whereas the group of students who changed major with a below passing grade-point-average were much lower on the whole than the other two groups. The mean score for the two groups, non-changers and changers above 2.0 grade-point-average, was 124.23, whereas the mean score for the group of below passing changers was 109.725. This indicates that the significant difference found in academic aptitude apparently lies between (a) the group changing major with a below passing grade-point-average and (b) the non-changers and above passing changers.

TABLE 3

MEAN SCORES AND ADJUSTED MEANS FOR GROUPS I, III, V, FEMALES

Instrument	k	Status	Mean	Average Mean	Adjusted Mean
Test of Critical Thinking	288	Non-changers	32.330		
	40	Changers, below 2.0 G.P.A.	27.050		
	233	Changers, 2.0+ G.P.A.	33.966	32.629	
College Qualifications Test	288	Non-changers	123.33		
	40	Changers, below 2.0 G.P.A.	109.725		
	233	Changers, 2.0+ G.P.A.	125.32	123.19	
Inventory of Beliefs	288	Non-changers	65.781		
	40	Changers, below 2.0 G.P.A.	64.150		
	233	Changers, 2.0+ G.P.A.	66.189		
Differential Values Inventory	288	Non-changers	34.549		34.547
	40	Changers, below 2.0 G.P.A.	39.950		40.233
	233	Changers, 2.0+ G.P.A.	33.948	35.493	33.708
Rokeach's Dogmatism Scale	288	Non-changers	164.01		
	40	Changers, below 2.0 G.P.A.	165.15		
	233	Changers, 2.0+ G.P.A.	163.98		

Critical thinking ability

TABLE 4

TEST OF SIGNIFICANCE FOR CRITICAL THINKING ABILITY FOR GROUPS I, III, AND V, FEMALES

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F
Total	560	26,747.9		
Groups	2	1,689	844.5	
Within	558	25,058.9	44.91	18.814

Results of the analysis of variance for the Test of Critical Thinking, Form G, Table 4, revealed that there is a significant difference among the three female groups in their critical thinking abilities. Reference to Table 3 shows that the group of students who changed major with a passing grade-point-average rated the highest on the Test of Critical Thinking, whereas the students as a group who changed major with a below passing grade-point-average were much lower on the whole than the other two groups. The mean score for the two groups, non-changers and changers above 2.0 grade-point-average, was 33.058, whereas the mean score for the below passing changers was 27.050. This indicates that the significant difference found for critical thinking ability apparently lies between (a) those changing major with a below passing grade-point-average and (b) the non-changers and the above passing changers.

Attitudes

TABLE 5

TESTS OF SIGNIFICANCE FOR ATTITUDES
FOR GROUPS I, III, AND V, FEMALES

Source of Variations	Residuals			
	Degrees of Freedom	Sums of Squares	Mean Square	F
	Inventory of Beliefs			
Total	558	82,411.7		
Groups	2	114.5	57.25	
Within	556	82,297.2	148.02	0.3868
	Rokeach's Dogmatism Scale			
Total	558	869,940.5		
Groups	2	765.2	382.6	
Within	556	869,175.3	1563.3	0.24474

Results of the analyses of covariance for the Inventory of Beliefs, Form I, Table 5, and Rokeach's Dogmatism Scale, Form E, Table 5, revealed no significant differences among the three female groups in their stereotypy, adaptivity, and independent beliefs. This is of particular interest as earlier studies on the parent population revealed that students' attitudes differed to a significant degree when classed according to their specific curricula. For example, females in the college of veterinary medicine are very stereotypic as compared to those in the non-technical curricula.[3]

[3]Lehmann and Ikenberry, loc. cit., p. 34.

Values

TABLE 6

TEST OF SIGNIFICANCE FOR VALUES FOR GROUPS I, III, AND V, FEMALES

		Residuals		
Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Total	558	27,489.63		
Groups	2	973.13	486.57	
Within	556	26,516.47	47.691	10.202

Results of the analysis of covariance for the Differential Values Inventory, Table 6, revealed that there is a significant difference among the three female groups in their emergent and traditional values. The groups of students who changed major with a passing grade-point-average and those who did not change major were much more emergent-value-oriented (Table 3) than the group of students who changed major with a below passing grade-point-average. An adjustment of the means (Table 3) revealed an even greater span between the two emergent-oriented groups and the group who were traditionally-value-oriented. It is evident from this that the differences in values of these groupings cannot be explained on the basis of differences in critical thinking ability and academic aptitude.

Summary

The foregoing analyses show that significant differences

exist among the three female groupings as related to their academic aptitudes and critical thinking ability, as revealed by the useage of The College Qualification Tests, Total Score and the Test for Critical Thinking, Form G, respectively.

No significant difference was found among the three female groupings in their attitudes, as measured by the Inventory of Beliefs, Form I and Rokeach's Dogmatism Scale.

However, a significant difference was found for the three female groupings in their traditionally-oriented versus emergent-oriented values, as tested by the Differential Values Inventory.

On the basis of the above results, Hypothesis I--There is no difference between female students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.--was rejected.

HYPOTHESIS II

There is no difference between male students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

Academic aptitude

TABLE 7

TEST OF SIGNIFICANCE FOR ACADEMIC APTITUDE FOR GROUPS II, IV, AND VI, MALES

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Total	791	513,304		
Groups	2	22,700	11,350	
Within	789	490,604	519.15	21.863

Results of the analysis of variance for The College Qualification Tests, Table 7, revealed that there is a significant difference among the three male groups in their academic aptitudes. The group of students who changed major with a below passing grade-point-average was decidedly lower in academic aptitude than the groups who did not change major and those who changed with a passing grade (Table 8). The mean score for the two groups, non-changers and changers above 2.0 grade-point-average, was 133.81, and the mean score for the group who were below passing changers was 118.09. This indicates that the significant difference in academic aptitude apparently lies between (a) the group changing major with a below passing grade-point-average and (b) the other two groups.

TABLE 8

MEAN SCORES AND ADJUSTED MEANS FOR GROUPS II, IV, VI, MALES

Instrument	k	Status	Mean	Average Mean	Adjusted Mean
Test of Critical Thinking	402	Non-changers	33.159		
	106	Changers, below 2.0 G.P.A.	29.642		
	284	Changers, 2.0+ G.P.A.	32.877	32.587	
College Qualification Tests	402	Non-changers	133.68		
	106	Changers, below 2.0 G.P.A.	118.09		
	284	Changers, 2.0+ G.P.A.	134.10	131.74	
Inventory of Beliefs	402	Non-changers	64.597		64.168
	106	Changers, below 2.0 G.P.A.	59.368		61.996
	284	Changers, 2.0+ G.P.A.	64.475	63.853	64.100
Differential Values Inventory	402	Non-changers	35.886		35.864
	106	Changers, below 2.0 G.P.A.	33.953		34.117
	284	Changers, 2.0+ G.P.A.	33.722	34.852	33.693
Rokeach's Dogmatism Scale	402	Non-changers	166.79		166.23
	106	Changers, below 2.0 G.P.A.	173.30		176.04
	284	Changers, 2.0+ G.P.A.	164.76	166.93	164.45

Critical thinking ability

TABLE 9

TEST OF SIGNIFICANCE FOR CRITICAL THINKING ABILITY FOR GROUPS II, IV, AND VI, MALES

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Total	791	36,084.4		
Groups	2	284	142	
Within	789	35,800.4	45.373	3.129

Results of the analysis of variance for the Test of Critical Thinking, Form G, Table 9, revealed that there is a significant difference among the three male groups in their critical thinking abilities. Reference to Table 8 reveals that the group of students who did not change major ranked highest as a group and the group who changed major with a below passing grade-point-average were the lowest. However, the mean score for the two groups, non-changers and changers above 2.0 grade-point-average, was 33.028, as compared with 29.642 for the group who changed major with below passing grade-point-average. This indicates that the significant difference found in critical thinking ability apparently lies between (a) those changing major with a below passing grade-point-average, and (b) the two groups, non-changers and above passing changers.

Attitudes

TABLE 10

TEST OF SIGNIFICANCE FOR ATTITUDES FOR GROUPS II, IV, AND VI, MALES

Source of Variation	Residuals			
	Degrees of Freedom	Sums of Squares	Mean Square	F
		Inventory of Beliefs		
Total	789	138,882.0		
Groups	2	2,214.4	1,107.4	
Within	787	136,667.6	173.66	6.3769
		Rokeach's Dogmatism Scale		
Total	789	493,460.1		
Groups	2	15,287.7	7,643.9	
Within	787	478,172.4	607.59	12.581

Results of the analyses of covariance for the Inventory of Beliefs, Form I, Table 10, and Rokeach's Dogmatism Scale, Form E, Table 10, revealed there is a significant difference among the three male groups in their attitudes. Mean scores for both tests (Table 8) reveal that the group of students who change major with a below passing grade-point-average are the most stereotypic and dogmatic in their beliefs. An adjustment of the means on the Inventory of Beliefs (Table 8) revealed that an adjustment for differences in critical thinking ability and academic aptitude showed this group to be slightly more adaptive and independent in their belief systems. However, an adjustment of the means on the Rokeach's Dogmatism

Scale revealed this group to be more stereotypic after consideration of differences in the intellective factors. Both before and after adjustment of the means, the group who changed major with below passing grade-point-averages were more dogmatic and less adaptive and independent in their belief systems than the other two groups, indicating that this group apparently tended to bring about the significant difference in attitudes among these groups as revealed in this study. It is also apparent that the significant differences in attitudes for the males, revealed in this study, cannot be explained on the basis of differences in academic aptitude and critical thinking ability.

Values

TABLE 11

TEST OF SIGNIFICANCE FOR VALUES FOR GROUPS II, IV, AND VI, MALES

		Residuals		
Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Total	789	38,638.2		
Groups	2	813.17	406.59	
Within	787	37,825.03	48.063	8.4596

Results of the analysis of covariance for the Differential Values Inventory, Table 11, revealed that there is a significant difference among the three male groups in their traditional values. The mean scores for the three groups (Table 8) reveal that the

students who changed major with a passing grade-point-average were the most emergent-oriented in their values, and an adjustment of the means, Table 8, revealed that this same group, after adjustment for differences in critical thinking ability and academic aptitude, are still the most emergent-value-oriented in their beliefs, as a group, whereas the group who did not change major were the most traditionally-value-oriented both before and after adjustment for differences in the cognitive variables considered. It is evident from this that the differences in values of these groupings cannot be explained on the basis of differences in the intellective factors.

Summary

The foregoing analyses show that significant differences exist among the three male groupings as related to their academic aptitudes, critical thinking ability, attitudes, and values, as revealed by the useage of The College Qualification Tests, Total Score; the Test for Critical Thinking, Form G; the Inventory of Beliefs, Form I; Rokeach's Dogmatism Scale; and, the Differential Values Inventory, respectively.

On the basis of the above results, Hypothesis II--There is no difference between male students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.--was rejected.

SUMMARY

This chapter has been devoted to determining the presence

or lack of relationships between some cognitive and non-cognitive variables and a student's persistence in his choice of major, as designated at time of entrance as a freshman at Michigan State University.

The freshman group used in this study was subdivided according to non-change of major, change of major; grade-point-average at time of change and, sex.

The investigation was based on the American-born members of the freshman class, fall quarter, 1958, who specified a major area of study at time of enrollment, and were still enrolled at Michigan State University the fall quarter, 1961.

The cognitive variables considered were critical thinking ability and academic aptitude, as measured by the Test of Critical Thinking and The College Qualification Tests, respectively. Analysis of these data by the statistical technique, analysis of variance, revealed that significant differences existed among the three groupings for both males and females in their critical thinking ability and academic aptitude. For both males and females, the group designated as changers with below passing grade-point-average at time of change of major were the lowest scoring groups on both the Test of Critical Thinking and The College Qualification Tests.

As a result of the differences revealed in the cognitive variables, the statistical technique, analysis of covariance, was employed for analyzing the data on the non-cognitive variables in order to control for bias due to differences in the cognitive areas.

The tests, Inventory of Beliefs and Rokeach's Dogmatism

Scale, used to determine the relationship of the groups on the basis of differences in attitudes. The male groupings revealed highly significant differences in stereotypy and adaptivity. Whereas, no significant difference was found for the three female groupings on the basis of dogmatism and receptivity to change. An adjustment of the means for the male groupings revealed that, both before and after adjustment, the male grouping, below-passing changers, were the most dogmatic and least adaptive in their belief systems. Thus indicating that the significant difference for the male groups cannot be explained on the basis of differences in the intellective factors.

The test of significance for values, based on the Differential Values Inventory, revealed that highly significant differences in values exist for the three groupings for both males and females. An adjustment of the means for both the male and female groupings revealed that the significant differences in values for the groupings could not be explained on the basis of differences in the critical thinking ability and academic aptitude.

On the basis of the results revealed in this study, it is necessary to reject both Hypothesis I and Hypothesis II as they are stated in the null form.

CHAPTER V

SUMMARY AND CONCLUSIONS

SUMMARY

Purpose of the study

The purpose of this study was to determine if students who change their major area of study after college entrance differ in certain cognitive and/or non-cognitive variables from students who choose a major area of study at time of college entrance and remain in that major area. Two major hypotheses were formulated: (1) There is no difference between female students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values, and (2) There is no difference between male students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

It was theorized that educational and vocational counseling and guidance would be of more value to the student in successful fulfillment of his academic program if a pattern relating to these cognitive and non-cognitive variables could be discerned.

A review of the literature revealed no studies directly relating to the problem under consideration. Some research has been done in studying the relationship of affective variables to

specific curricula, but not to the student who changes from one major area of study to another.

Design of the study

The population under investigation consisted of 561 female students and 792 male students who entered Michigan State University the fall quarter of 1958 and were still enrolled fall quarter, 1961. Only those students classes as American-born freshmen, who had not attended another college or university, and were enrolled for 12 credits or more, were included in the study.

In order to test the hypotheses of the study, it was necessary to collect data relevant to the critical thinking ability, academic aptitude, attitudes, and values of the population studied. The cognitive variables were measured by the Test of Critical Thinking, Form G and The College Qualification Tests, Total Score, respectively. The non-cognitive variables, attitudes and values, were measured by the Inventory of Beliefs, Form I, Rokeach's Dogmatism Scale, and the Differential Values Inventory, respectively.

Data pertaining to male and female students were examined independently because of sex differences found in initial studies on the parent population.[1]

Data pertaining to those who changed their major area of study were classified according to whether or not the student was maintaining a passing grade-point-average of 2.0 at the time of change of major area of study.

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[1]Lehmann and Ikenberry, loc. cit., p. 17.

Analysis of variance was selected as the statistical technique to be used to test the hypotheses. However, the analyses of variance on the cognitive variables revealed that differences did exist between the groups for the intellective characteristics. Since relationships do exist between cognitive and non-cognitive variables, it was decided that results would be more discerning if the statistical technique, analysis of covariance, were employed, using the scores of the Test of Critical Thinking, Form G and The College Qualification Tests, Total Score as the control variables to remove bias due to differences in the intellective factors for the groups being studied.

Findings of the study

The tests of significance for the specific variables revealed the following:

1. a significant difference among the three female groupings in their academic aptitudes;

2. a significant difference among the three female groupings in their critical thinking ability;

3. no significant differences in stereotypy and adaptivity for the female groupings;

4. a significant difference among the three female groups on the basis of their traditional values;

5. a significant difference among the three male groupings in their academic aptitudes;

6. a significant difference among the three male groupings in their critical thinking abilities;

7. a significant difference among the three male groupings in their stereotypic beliefs and receptivity to change; and,

8. a significant difference among the three male groupings in their traditional values.

CONCLUSIONS

Female students who changed major with a below passing grade-point-average were the most traditionally-value-oriented group, both before and after adjustment of the means to remove bias due to the cognitive variables. It appears that the differences cannot be explained on the basis of the differences in the intellective factors.

The test of significance for attitudes and values for the male groupings revealed significant differences among the three groupings on all three of the non-cognitive variables. An inspection of the mean scores, both before and after adjustment for differences in the cognitive variables, revealed that the group designated male changers, below 2.0 grade-point-average, rated the least open-minded by Rokeach's Dogmatism Scale, the most stereotypic by the Inventory of Beliefs, and the most traditionally-value-oriented by the Differential Values Inventory. It appears that this particular group may be the factor that led to the significant differences found for the non-cognitive variables for the males in this investigation.

It is interesting to note that although significant differences for the three female groupings were found for only one of

the non-cognitive variables, values, an inspection of the mean scores on the non-cognitive tests revealed that like the male students, the female group designated changers, below 2.0 grade-point-average, were the most stereotypic, least adaptive, and most traditionally-value-oriented.

Hence, after adjustment for differences in intellective factors, it was found that in every case the group designated as below passing changers were the most dogmatic, the most stereotypic, and the most traditionally-value-oriented. It appears, therefore, that this grouping, designated changers, below 2.0 grade-point-average at time of change, may be the group that led to the significant differences found for the groupings in this investigation.

In the preliminary report on the parent population, Lehmann and Ikenberry[2] reported significant relationships exist between scholastic performance, critical thinking ability, attitudes, and values. This appears to be true also in this study, as both the male and female groups who were lowest in academic aptitude were the lowest on the intellective factors, the least open-minded, the most stereotypic and the most traditionally-value-oriented.

Marshall and Simpson[3] found that students who were not definite in their vocational choice were lower in academic performance than students with definite vocational aims. In this study the group who changed major with below passing grade-point-average appears to support this theory. However, this study

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[2]Lehmann and Ikenberry, loc. cit.

[3]Marshall and Simpson, loc. cit.

revealed an appreciable group of students who changed major area of study with an above passing grade-point-average, and therefore, appears to be contradictory to the general theory of Marshall and Simpson. However, the group designated as below passing changers in this study substantiates the findings of Brass[4] who reported that one of the major reasons students change their curricula is because of poor grades. Brass also reported that students in the degree-granting curricula tended to improve their grade-point-averages after changing. Since students in the present study are still in college two years after matriculation, and therefore most of these students should have the academic aptitude for college level work, it seems highly probable that a follow-up study on the below passing changers should reveal an increase in their grade-point-average after final selection of their major area of study.

The study by Fullmer[5] showed the non-changers as the group highest in academic ability, whereas in the present study the group highest in academic aptitude were the changers with an above 2.0 grade-point-average.

Middleton and Guthrie[6] found that different personality factors tended to be associated with different levels of achievement. This is also true in this study for the two groups of changers, as the below-changers were more dogmatic, more stereotypic,

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[4]Brass, loc. cit.

[5]Fullmer, loc. cit.

[6]Middleton and Guthrie, loc. cit.

and more traditionally-value-oriented than the above passing changers. Since the academic achievement of the non-changers was not studied in this investigation, there is insufficient information on this group to associate personality factors with academic success.

It appears evident, from the results found in this investigation, that changing of major area of study, at least for the students with low academic success, may be associated with certain cognitive and non-cognitive variables.

On the basis of the results revealed by this study, it is necessary to reject both Hypothesis I--There is no difference between female students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.--and Hypothesis II--There is no difference between male students who change major and those who do not change major on the basis of academic aptitude, critical thinking ability, attitudes, and values.

Suggestions for further research

Since the results of the tests of significance on the variables investigated revealed a number of significant differences among the groups in this study, it is evident that further investigation is needed.

The most apparent problem revealed by this study is the need for further investigation into the problems and needs of those students who change their major area of study with a below passing grade-point-average. Are these students failing because of low

academic aptitude or because they are in the wrong curriculum? Would a follow-up study on these students reveal that they are successful in their final choice of major area of study? Is there lack of success in an area related to their values? Is their lack of success in an area related to their attitudes? Do their attitudes change after they change their area of study? Do their values change in the new area of study?

Further study based on individual curricula may reveal that certain of these variables could be identified with a specific major area of study for the purposes of educational and vocational guidance. Horst[7] and others have conducted extensive investigations into the useage of sub-batteries of rating scales for vocational counseling. The differences found in the variables for the groups studied in the present investigation leads one to assume that further research with these variables for the individual curricula should be done to determine if these variables can be associated with success in certain academic areas. How large a factor are a student's attitudes and values as related to his success in a given field? Is success in a specific curriculum related to a student's attitudes? Is success in a specific curriculum related to a student's values?

Webster[8] found that a student's attitude changes during his college career. Would follow-up studies on a group, such as this population, reveal that the changes in attitudes can be associated

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[7]Horst, loc. cit.

[8]Webster, loc. cit.

predominantly with one of the groups of changers or the non-changers?

In the study by Payne[9] it was revealed that students become less stereotypic during their freshman year in college. Would further study reveal that these students fall predominantly in one of the three groups used in this study?

The question arises as to which of the many variables that could be considered in guidance work would be the most pertinent when a student is making a decision relative to a change in his major area of study. Which is the most pertinent factor as related to his specific problems? For example, is critical thinking ability a larger factor in one area of study than in another? Would the relationship of certain cognitive and non-cognitive variables be more specific to one area than another?

It is without doubt evident that further investigation with other variables is highly recommended. Would an investigation using other variables reveal other differences among these same groupings? Would such a study also show the group of changers with below passing grade-point-averages as the group most apparently in need of further study? A number of studies using such tools as the MMPI[10,11] and PIV[12] have indicated that students in certain major

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[9]Payne, loc. cit.

[10]Norman and Redlo, loc. cit.

[11]Centi, loc. cit.

[12]Warnath and Fordyce, loc. cit.

areas have similar characteristics. Would further investigation with these rating scales reveal differences for students who change their major area of study?

These and other questions deserve further study. However, this study provides evidence that differences in some cognitive and non-cognitive factors do exist between students who change, and students who do not change, their major area of study in college.

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APPENDIX A

TABLE 1

CODE NUMBERS OF CURRICULUMS AT MICHIGAN STATE UNIVERSITY

Code	Curriculum
00	University College - No Preference
10	Agriculture; Short Courses; Agriculture Industries
12	Agricultural Science
13	Agricultural Science
14	General Agriculture
15	Fisheries and Wildlife
16	Forest Products
17	Forestry
18	Park Management
20	Accounting & Financial Adm.
21	Hotel, Restaurant and Institutional Management
22	Business Services
23	Urban Planning and Landscape Architecture
24	Police Administration and Public Safety
25	Political Science
26	Social Work
27	Economics
28	Marketing and Transportation Administration
29	Personnel and Production Administration
30	Engineering (no major)
31	Agricultural Engineering
32	Applied Mechanics
33	Chemical Engineering
34	Civil Engineering
35	Electrical Engineering
36	Mechanical Engineering
37	Metallurgical Engineering
38	Sanitary Engineering
39	Engineering for International Service
40	Home Economics
50	Fine Arts
52	Language and Literature; Humanities
55	Biological Science
56	Mathematics and Physical Sciences
57	Social Science
58	Pre-Dental
59	Pre-Medical
60	Veterinary Medicine
61	Medical Technology
62	Pre-veterinary
70	Education--Master's and Doctoral Level
71	Elementary Education
72	Industrial Arts
73	Health, Physical Education and Recreation

TABLE 1--Continued

Code	Curriculum
80	Unclassified and Workshop
81	American Language Education Clinic
88	Off-Campus
91	Advertising
92	Journalism
93	Television and Radio
94	General Communication Arts
96	Speech

TABLE 2

CURRICULUM CHANGES[a] CLASSIFIED AS NON-CHANGE IN MAJOR. CHANGES IN CURRICULUM CODE NUMBERS[b] WITHIN GROUPS (1) THROUGH (9) ARE NOT CONSIDERED AS CHANGE-OF-MAJOR.

(1)	10, 12, 13, 14, 15, 16, 17, 18, 31.
(2)	20, 21.
(3)	25, 27.
(4)	30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 56.
(5)	50, 52, 57.
(6)	55, 58.
(7)	55, 59, 60, 62.
(8)	55, 61.
(9)	91-92.

[a]As classified for this study.

[b]See Table 1.

TABLE 3

CURRICULUM CHANGES[a] CLASSIFIED AS CHANGE-OF-MAJOR. CHANGES IN CURRICULUM CODE NUMBERS[b] ACCORDING TO THE FOLLOWING PAIRS OF NUMBERS WERE CONSIDERED AS CHANGE-OF-MAJOR.

20-22	21-25	26-57	55-73	96-94
20-24	21-29	26-25	59-34	94-52
20-25	21-91	26-29	59-56	94-57
20-27	21-93	40-26	62-56	91-94
20-28	21-57	45-57	71-73	92-50
20-29	24-57	50 or 52-92	96-52	92-52
20-47	24-93	50 or 52-94	96-57	92-94
20-91	24-25	50 or 52-96	96-50	92-96
20-93	25-22	50 or 52-91	96-91	
21-24	25-29	55-56	96-93	

[a]As classified for this study.

[b]See Table 1.

APPENDIX B

TABLE 4

MEANS, STANDARD DEVIATIONS, AND GROUP

Tests		I.B.[a]		C.T.		DVI		RDS		CQT-T	
Group	Number	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
I	288	65.781	12.710	32.330	6.8144	34.549	7.0694	164.01	24.154	123.33	23.631
II	402	64.597	13.550	33.159	7.1135	35.886	6.9488	166.79	25.172	133.68	26.708
III	40	64.150	11.922	27.050	6.8810	39.950	6.4146	165.15	25.690	109.725	21.330
IV	106	59.368	14.887	29.642	5.9196	33.953	7.3026	173.30	23.584	118.09	21.123
V	233	66.189	12.611	33.966	6.4820	33.948	6.6453	163.98	54.141	125.32	23.681
VI	284	64.475	13.976	32.877	6.4307	33.722	6.7226	164.76	25.848	134.10	22.717

[a] I.B.--Inventory of Beliefs, Form I
C.T.--Test of Critical Thinking, Form G
DVI--Differential Values Inventory
RDS--Rokeach's Dogmatism Scale, Form E
CQT-T--The College Qualification Tests, Total Score

TABLE 5

CORRELATION VALUES

Test's Correlation[a]	Group I Non-Changers Female	Group II Non-Changers Male	Group III Changers Below 2.0 Female	Group IV Changers Below 2.0 Male	Group V Changers 2.0+ Female	Group VI Changers 2.0+ Male
I.B.--C.T.	0.26117	0.35663	0.17271	0.217534	0.14977	0.20766
I.B.--CQT, T	0.28344	0.35520	0.19050	0.20792	0.26551	0.17209
DVI--C.T.	0.019453	0.012950	0.11447	0.02143	0.053047	0.031785
DVI--CQT, T	0.078344	0.033365	0.23104	0.033120	0.036032	0.063914
RDS--C.T.	0.19459	0.24792	0.23283	0.15019	0.013271	0.20610
RDS--CQT, T	0.17579	0.17538	0.29853	0.031588	0.042163	0.14111
C.T.--CQT, T	0.57376	0.61901	0.61484	0.44518	0.52986	0.45565

[a]I.B.--Inventory of Beliefs, Form I
C.T.--Test of Critical Thinking, Form G
DVI--Differential Values Inventory
RDS--Rokeach's Dogmatism Scale, Form E
CQT, T--The College Qualification Tests, Total Score

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